Fisheries and Oceans Canada | Pêches et Océans Canada
Science | Sciences
Maritimes Region
Canadian Science Advisory Secretariat
Science Response 2012/038

REVIEW OF THE DONKIN EXPORT COKING COAL PROJECT ENVIRONMENTAL ASSESSMENT

Context

Fisheries and Oceans Canada's (DFO) Habitat Management Division, Maritimes Region, is reviewing an Environmental Impact Statement (EIS) for the re-opening of Donkin Coal Mine in Sydney, Cape Breton, to determine if the project is likely to result in negative impacts to fish and fish habitat. DFO's Ecosystem Management Branch requested that DFO Science review the EIS and address some specific questions.

The specific questions from DFO Ecosystem Management Branch to DFO Science were:

- Based on the project as proposed, are the environmental effects identified complete for: freshwater fish and fish habitat; the marine environment; and, commercial and recreational fisheries?
- Are the methodologies used to describe these effects appropriate?
- In consideration of the methodology used, do the results support the conclusions as presented?

This Science Response report is from the Regional Science Special Response Process (SSRP) of May 2012 on the Review of the Donkin Export Coking Coal Project Environmental Assessment. DFO's SSRP was used to review the EIS and provide input due to the short deadline for advice and the fact that the advice will contribute to a broader *Canadian Environmental Assessment Act* process.

This Science Response Report results from the Science Special Response Process that included an initial DFO review of a draft EIS (May 2012), as well as a more recent DFO review of an updated version of the EIS (July 2012) and a disposition table that lists the proponent's response to comments received from regulators during the initial review of the draft EIS.

Overall, the quality of scientific content presented in the EIS is of a high level and sound. Although most previous DFO comments have been addressed adequately, it is important to recognize that uncertainty remains for several areas of concern, and caution is warranted with respect to these areas, in particular: the long term stability of geosynthetic clay liners; assumptions on how PAH exposure will impact the health of aquatic animals; the effect that sea ice may have on the project; the effects of noise transmission to the marine environment; the increased risk of vessel strikes on turtle and whales; and the likelihood and cumulative impacts of several adverse situations occurring simultaneously.

Also, if particular mitigation practices are proposed to reduce risk, such as vessel routing or speed restrictions, sufficient monitoring, verification and enforcement processes may be necessary.

Canada

Background

The project involves a proposal to construct and operate an underground coal mine facility at the site of the existing Donkin Mine located on the Donkin Peninsula in Cape Breton Regional Municipality, Nova Scotia (Figure 1). The Project proposes a multi-continuous miner underground operation producing approximately 3.6 million tonnes per annum (Mtpa) of Run of Mine coal that is subsequently washed to provide approximately 2.75 Mtpa of product coal that is primarily suitable for coking coal markets, but may also supply thermal coal markets. A Coal Handling and Processing Plant capable of processing 3.6 Mtpa of raw coal from the Donkin Mine will be constructed to produce coal ready for presentation to a barge load-out facility. Waste coal and rock will be disposed onsite in surface containment systems engineered to manage runoff.

Product coal will be loaded onto circa 4,000 deadweight tonnage barges, which will be tugged an estimated 8.8 km to a transshipment facility in deeper waters in Mira Bay where it will be loaded onto bulk carriers up to Cape Size vessels for transport to international markets. While the primary method of product coal transportation for the Project is marine transportation, trucking of coal may occur should marine transportation prove impractical at any time.

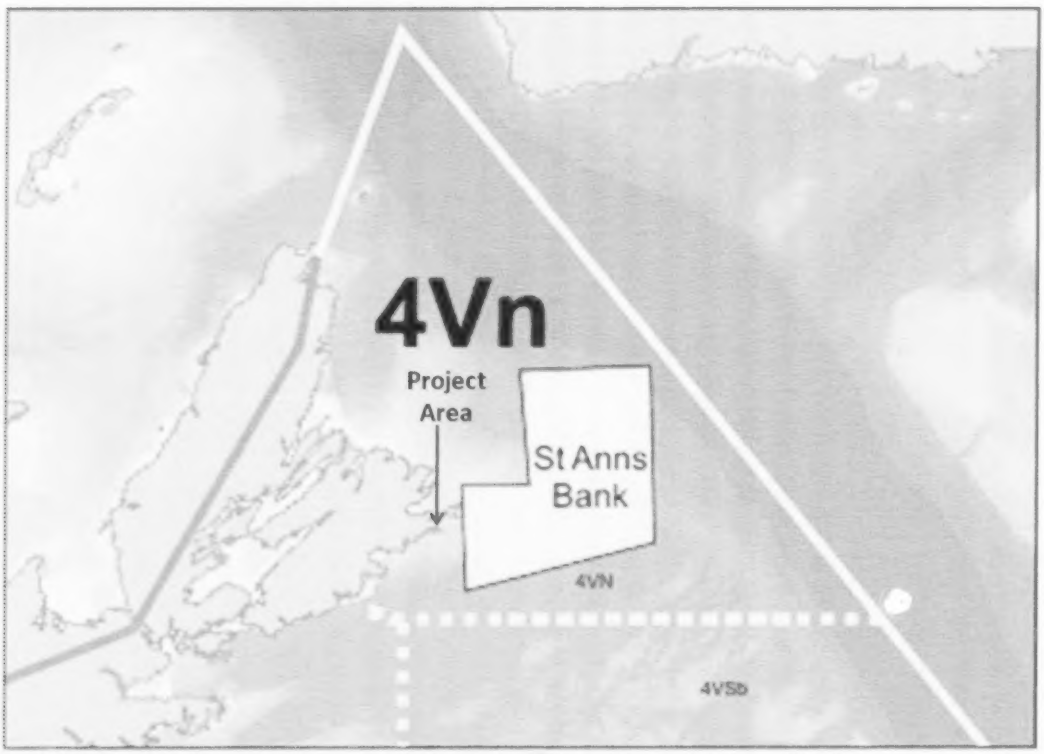

Figure 1. Location of the project area in relation to Unit Area 4Vn and St Anns Bank.

Analysis and Response

Freshwater Fish and Fish Habitat

It is well established that the run-off from the mine solid wastes will be highly acidic and must be isolated from primary contact with deeper ground water and direct release into streams and wet lands. While a collection and treatment will be employed during the active operational period of the mine, and a seal cap (both top and bottom) is proposed for post-mine decommissioning, DFO initially questioned whether there was evidence on how effective both top and bottom seals would be over long post-mining time spans.

In response, the proponent stated that since the 1980s, geosynthetic clay liners (GCLs) have been used in a variety of permanent applications such as landfills, canals, waterways, storage tanks and roadways. The proposed capping detail, indicated as Figure 3.1 on page 3.11 of Concept Study on Coal Waste Disposal Options, includes a GCL covered by 300 to 500 mm of topsoil. A study carried out to determine the durability and lifetime of polymer fibers with respect to reinforced geosynthetic clay barriers, i.e. reinforced GCLs, found that a GCL under varying oxygen conditions would last from 89 years up to 278 years (Hsuan and Koerner 2002). According to the study, oxygen levels for this particular application are estimated to be between 5 and 8 percent, which indicates a life expectancy closer to the 278 years.

Presumably, in the larger Cape Breton coal mining area there is already a great abundance of mining wastes that have not been dealt with as effectively as proposed in the current Donkin EIS. Although it is assumed that the proposed liners will be stable on a relatively short "historical" time scale, there is evidence that erosion, freeze-thaw cycles, tree roots, etc. can damage and/or poke holes in the GCL, greatly limiting its short-term effectiveness, not to mention its long-term effectiveness. There are many examples of GCLs being used to successfully manage mine wastes at various sites around the world, but it is also generally understood that they need to be carefully managed and monitored over time to keep track of their performance. Also, it is not clear why the GCL cap is being proposed when Enterprise Cape Breton Corporation recently used a more robust cap to remediate similar historical wastes at the nearby Gowrie Wash Plant site. This cap utilized 150 mm sand bedding layer, a 1.5 mm high-density polyethylene liner, a geocomposite geonet drainage layer and a 600 mm compacted layer of glacial till, with the upper part having soil amendments covered with hydraulic seeding. The GCL covered by 300-500 mm of soil sounds like a fairly simplistic approach in comparison and, if implemented, will need to be carefully managed and monitored over operational and post-operational time scales in order to keep track of its performance.

The Marine Environment

Direct Habitat Alteration and Fish Mortality

It is important to consider that the coal dust overlaying sediments could be ingested by organisms who feed on detritus that they consider as food. Lobsters and worms are known to consume any material without much discrimination, but less is known about crab. Once these particles are in the digestive system, they would absorb soluble chemicals and adhere to the digestive system for a longer period of time than biologically derived particles. They would be expected to interfere with the feeding process.

A review by Ahrens and Morrisey (2005) states that there are limited data on the toxic effects or bioavailability of coal in the literature. The authors mention that abrasion, smothering, clogging

of respiratory and feeding organs can take place. It has also been reported in a study of Roberts Bank, British Columbia, that Dungeness crab that were fished near a coal tar terminal had a dark coloration making them unappealing to customers and difficult to sell (Johnson and Bustin 2006). This publication was not very comprehensive, reporting concerns from fishermen rather than international scientific studies. Overall, there is limited information on the potential impacts of coal dust on the health of aquatic species.

The EIS relies on knowledge generated from a coal operation in Australia and states that the potential for widespread environmental effects from coal and coal dust on the marine environment is very low. Although similar effects may be observed for the Donkin mine, it is important to recognize that coal contains carcinogenic polycyclic aromatic hydrocarbons (PAH) and metals, and it is unclear whether the potential harmful effects of these substances were studied in relation to the Australian operation. The environmental effects of these substances should to be taken into account when making assumptions on how PAH exposure will impact the health of aquatic animals.

The construction of the barge loading terminal will have environmental impacts, but these effects should be transitory. Fortunately, no pile-driving or marine blasting (both of these can and do kill fish) will apparently be employed in construction of the marine loading terminal (EIS page 5.339). Heavy blasting near or on the coast can kill marine organisms, but no above-ground blasting will be conducted on site. All excavation, including cuts in the cliff to accommodate the marine loading conveyor, will be conducted by earth-moving equipment (e.g., dozer ripping and/or hydraulic rock breaker).

Marine Mammal, Turtles and Vessel Collisions

According to the EIS,14 species of cetaceans and 2 species of sea turtles (leatherback and loggerhead sea turtles) may be expected to occur with varying frequency in the coastal habitats of Sydney Bight.

Increased vessel traffic always imposes increased risks of marine mammal and turtle strikes by ships, especially to baleen whales. The Regional Assessment Area (RAA), Local Assessment Area (LAA), and Project Development Area are within the path of some of the marine mammals and sea turtles migrating in the Gulf of the St. Lawrence and Sydney Bight areas. According to the proponent, whale species, including baleen whales, would not be spending a majority of their time in the Project area as they are not areas known for birthing, calving or rearing young and, as a result, the chance of marine mammal ship strikes is anticipated to be minimal, unlike locations where marine mammals congregate for these life-cycle purposes. Sea turtles have been known to forage in areas along the coastline of Cape Breton's eastern shore and would likely be present throughout the entire RAA between June to October (DFO 2011b).

Given the presence of known whale and sea turtle foraging and migration areas and the increased risk of vessel strikes, consideration should be given to employing the use of speed limit restrictions and vessel routing, at least for peak whale and turtle migrations periods and routes. In the event that vessel routing or speed restrictions were deemed necessary, consideration should be given to what would be required to effectively and efficiently monitor and enforce these restrictions.

Underwater Noise from Construction and Operation

There is going to be a lot of additional vessel activity, both intensive barge and tug traffic between the barge loading terminal and the trans-shipment mooring, and local bulk carriers

transiting to the trans-shipment point (EIS page 5.348). Ships, and especially very large ships, radiate a fair amount of noise and, while this noise is unlikely, except in rare circumstances, to result in direct physical injuries to marine organisms, it constitutes a stressor and could influence marine organism behaviours in the LAA and even the RAA. The proponent acknowledges that vessel noise will have some environmental effects (Section 5.7.4.1.3 of the EIS). It is agreed that it is difficult to do anything without some environmental impacts, and there will no doubt be some degradation of fish habitat, even if mild. The presence of pre-existing vessel traffic would make development of mitigating compensation a challenging task.

The undersea mining operations generate noise that could be conducted through the rock to the overlying seabed and ocean. The EIS states that a boring machine will be used to construct a new access tunnel, and mining operations sometime employ blasting (probably small). Coal mines tend to be relatively shallow operations (page 2.24 of the EIS states that mining operations will be conducted at > 200 m below the sea level) and, in Cape Breton, are commonly underwater where the blast waves can propagate directly upward to the seabed. It is doubtful that a blast with acutely injurious pressure levels would be propagated to the seabed or into the water column, but they might constitute an occasional source of disturbance for marine life. Although the noise conducted to the water from tunnelling, rock drills, coal excavators, or even minor blasting may be at low level, detailed noise transmission tests have not been conducted. It should be noted that the minimum possible distances from blast to seabed are not very different from other mining projects that have been assessed in Maritimes Regions. Presumably, mine blasts at Donkin will be much smaller in comparison, but the mine geometry might be more conducive to efficient transfer of blast energy to the seabed.

In the original draft EIS, the contents of Table 5.7.17 was misinterpreted as it contained acoustic source levels characterizing various vessels, which on page 5-358 seem to be interpreted directly as radiated ambient noise levels for comparison with the Turnpenny and Nedwell (1994) damage criteria. Since the ambient radiated noise levels will be somewhat less than the source levels, their conclusions remain generally valid. The proponent made the appropriate change to the EIS.

Sea Ice

In its previous review, DFO highlighted the fact that late winter and spring pack-ice is known to accumulate around the project area and could affect the risk of coal-related shipping accidents. Furthermore, DFO suggested that vessel traffic could be interrupted by ice, forcing coal to be transported by road or rail for extended periods or stockpiled on-site to an extent where run-off from heavy spring rains could not be adequately handled.

The proponent pointed out that the potential for pack ice to affect operations has been addressed in marine engineering studies and is referred to in section 8.4 of the EIS. Specifically, the operating schedule has been developed in considerations of historical pack ice development. Monitoring of the Arctic ice flow information as it travels south in the North Atlantic will occur to determine what action is required, if any, for the marine operations.

However, it is reiterated that, while the impacts of various adverse situations in isolation can be planned for, crises often occur when several adverse situations occur simultaneously.

Environmental criteria for operations could be used to mitigate the risk of coal-related shipping accidents and could be described in a document such as the Terminal Operations Manual. The EIS describes acceptable working conditions for sea state (1.5-2.0 m), but not for sea ice (page 2.35). The criteria should consider individual and cumulative effects of factors such as ice

thickness, ice concentration, wind speed, and sea state. It is suggested that the management plan include provisions for both ice monitoring and ice forecasting.

In addition, the EIS states, "Provision for ice breaking from the Canadian Coast Guard may be required for operations during this period." (page 2.35) but has consideration been given to the fact that icebreaker services may not be available when required.

The proposed project includes the use of a single-point mooring buoy located where ice may be present between early-January and mid-May. However, little information is provided on the design criteria of the buoy with regard to sea ice (or other factors) and whether there are examples of other operations involving a single-point mooring buoy in ice-infested waters.

The EIS also states (page 8.12) that, "The design of the single point mooring buoy for resistance to ice flow will be determined on agreed risk factor for ice events - e.g., the decision to be made to design the buoy such that it could withstand a 1 – 30 year return event on Arctic ice flow. If this was the case then when a greater event was predicted, through monitoring of the Arctic ice flow information as it travels south in the North Atlantic, the buoy would have to be removed." With respect to the "agreed risk factor for ice events", a better explanation could be provided on how the data will be used and the overall determination process (e.g., who will determine what the risk factor are?). Also, it is unclear how "a greater event" will be predicted (e.g., numerical forecast model), what information would be used, and who would operate the model. Also, it would be useful to include an estimate of how much lead time would be required to remove the buoy.

It is important to note that the term "ice drift" rather than "ice flow" is the more commonly used term. Also, it is unclear if by "ice events" the proponent is referring to "extreme ice loads". The EIS states that the "Arctic ice flow" will be monitored, but sea ice in the area is typically from the Gulf of St. Lawrence (as stated on page 5.271), although some ice could conceivably drift from the Arctic and Labrador Sea.

Also, it is unclear whether sea ice has been considered in the design criteria for the barge load-out facility (page 2.63 of the EIS).

Commercial and Recreational Fisheries

Lobster

Based on consultations with local fishers and DFO, as well as the results of an aerial survey, it is assumed that all coastal areas in the LAA are exploited for lobster.

Increased suspended sediments could impact larval behavior/mortality during construction and possibly operation and the deposition of fine particles in the benthos may affect settlement of young of the year lobsters in nearshore habitats. To avoid these impacts, the proponent has stated that rock material used in the construction will be free of excessive fines and/or sources of sediment. Also, the substrate in the footprint of the barge load-out facility is comprised of predominately gravel and cobble and, thus, would not be a source of suspended sediments when disturbed. As long as a sufficient monitoring and verification practises are followed, this should serve as adequate mitigation.

Baseline studies and long-term monitoring are needed to determine what changes (positives or not) may occur and to assess if further mitigation measures would be needed. With respect to baseline information and long term monitoring, the continuity of the Atlantic Lobster Settlement

Index project led by J. Tremblay (DFO Maritimes Science) in False Bay (2008-2009) could be considered.

Herring

Historically, herring fishing areas included Morien Bay and Mira Bay; however, in recent years the fishery has taken place in the bays to the north of the Donkin peninsula. In addition to the spring spawning between April 28 and June 17 in various locations off New Waterford, Glace Bay and Port Morien (Crawford 1978), DFO has recorded fall spawning between September and October in Glace Bay (DFO 2011a). While the current herring roe fishery for Unit Area 4Vn occurs outside the LAA, it is possible that the project could impact herring spawning activities and/or locations within the RAA.

Other Fisheries

The EIS indicate that the majority of non-lobster fishing efforts occur outside the LAA.

Conclusions

It should be noted in these conclusions are reliant upon the availability of expertise within DFO Maritimes Region during the requested timeframe for document review. Given the deadline to provide review in the assessment was short, not all subject matter experts may have been available to provide input to either the initial review of the documentation or to the subsequent review of the draft document.

Overall, the quality of scientific content presented in the EIS is of a high level and sound. Although most previous DFO comments have been addressed adequately, it is important to recognize that uncertainty remains for several areas of concern, and caution is warranted with respect to these areas, in particular:

- the long term stability of geosynthetic clay liners;
- assumptions on how PAH exposure will impact the health of aquatic animals;
- the effect that sea ice may have on the project;
- the effects of noise transmission to the marine environment;
- the increased risk of vessel strikes on turtle and whales;and
- the likelihood and cumulative impacts of several adverse situations occurring simultaneously.

Also, if particular mitigation practices are proposed to reduce risk, such as vessel routing or speed restrictions, sufficient monitoring, verification and enforcement processes may be necessary.

Contributors

Name	Affiliation
Hellou, Jocelyne	DFO Science, Maritimes Region
Cochrane, Norman	DFO Science, Maritimes Region
Floyd, Trevor	DFO Science, Maritimes Region
James, Mike	DFO Science, Maritimes Region
Parson, Michael	NRCan, Marine Environmental Geoscience
Peterson, Ingrid	DFO Science, Maritimes Region
Silva, Angelica	DFO Science, Maritimes Region
Singh, Rabindra	DFO Science, Maritimes Region
Tremblay, John	DFO Science, Maritimes Region
Worcester, Tana	DFO Science, Maritimes Region

Approved by

Alain Vézina
Regional Director of Science, DFO Maritimes Region
Dartmouth, NS
Ph. 902-426-3490

Date: October 24, 2012

Sources of Information

Ahrens, M.J., and Morrisey, D.J. 2005. Biological effects of unburnt coal in the marine environment. Oceanography and Marine Biology: an annual review. 43:69-122.

Crawford, R.H. 1978. A biological survey of the Nova Scotia herring fishery, 1978. Nova Scotia Department of Fisheries Resource Utilization Division. Manuscript and Technical Report Series. Project Report No. 7905.

DFO. 2011a. Assessment of 4VWX Herring. DFO Can. Sci. Advis. Sec. Advis. Rep. 2011/046.

DFO. 2011b. Using Satellite Tracking Data to Define Important Habitat for Leatherback Turtles in Atlantic Canada. DFO Can. Sci. Advis. Sec. Sci. Advis. Rep. 2012/036.

Hsuan, Y.G., and Koerner, R.M. 2002. Durability and lifetime of polymer fibers with respect to reinforced geosynthetic clay barriers; i.e., reinforced GCLs. Drexel University, Geo synthetic Research Institute, Philadelphia, PA, USA. Clay Geosynthetic Barriers, Zanzinger, Koerner and Gartung (eds), ISBN 90 5809 380 8."

Johnson, R., and Bustin, R.M. 2006. Coal dust dispersal around a marine coal terminal (1977–1999),British Columbia: The fate of coal dust in the marine environment. International Journal of Coal Geology 68: 57-69.

Turnpenny A.W.H., and Nedwell, J. R. 1994. The effects on marine fish, diving mammals and birds of underwater sound generated by seismic surveys. FARL Report Reference: FCR 089/94, October 1994.

This Report is Available from the

Center for Science Advice (CSA)
Maritimes Region
Fisheries and Oceans Canada
P.O. Box 1006, Stn. B203
Dartmouth, Nova Scotia
Canada B2Y 4A2

Telephone: 902-426-7070
Fax: 902-426-5435
E-Mail: XMARMRAP@dfo-mpo.gc.ca
Internet address: www.dfo-mpo.gc.ca/csas

ISSN 1919-3750 (Print)
ISSN 1919-3769 (Online)
© Her Majesty the Queen in Right of Canada, 2012

La version française est disponible à l'adresse ci-dessus.

Correct Citation for this Publication

DFO. 2012. Review of the Donkin Export Coking Coal Project Environmental Assessment. DFO Can. Sci. Advis. Sec. Sci. Resp. 2012/038.